

# SEQUENCE LISTING

<110> DUSCH, Nicole  
THOMAS, Hermann  
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<120> PROCESS FOR THE FERMENTATIVE PREPARATION OF D-PANTOTHENOIC  
ACID USING CORYNEFORM BACTERIA

<130> 21354US0X

<150> DE 10048604.5

<151> 2000-09-30

<150> DE 10117085.8

<151> 2001-04-06

<160> 14

<170> PatentIn version 3.1

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<212> DNA

<213> Corynebacterium glutamicum

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497

Glu Trp Val His Val Arg Asn Glu Glu Ala Ala Ala Phe Ala Ala Gly

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Ala Glu Ser Leu Ile Thr Gly Glu Leu Ala Val Cys Ala Ala Ser Cys

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Gly Pro Gly Asn Thr His Leu Ile Gln Gly Leu Tyr Asp Ser His Arg

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641

Asn Gly Ala Lys Val Leu Ala Ile Ala Ser His Ile Pro Ser Ala Gln  
 90 95 100 105

att ggt tcg acg ttc ttc cag gaa acg cat ccg gag att ttg ttt aag  
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 Ile Gly Ser Thr Phe Phe Gln Glu Thr His Pro Glu Ile Leu Phe Lys  
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gaa tgc tct ggt tac tgc gag atg gtg aat ggt ggt gag cag ggt gaa  
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cgc att ttg cat cac gcg att cag tcc acc atg gcg ggt aaa ggt gtg  
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 Arg Ile Leu His His Ala Ile Gln Ser Thr Met Ala Gly Lys Gly Val  
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 Ser Val Val Val Ile Pro Gly Asp Ile Ala Lys Glu Asp Ala Gly Asp  
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 Gly Thr Tyr Ser Asn Ser Thr Ile Ser Ser Gly Thr Pro Val Val Phe  
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 Lys Ser Val Thr Leu Phe Cys Gly Ala Gly Val Lys Asn Ala Arg Ala  
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cag gtg ttg gag ttg gcg gag aag att aaa tca ccg atc ggg cat gcg  
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Gln Val Leu Glu Leu Ala Glu Lys Ile Lys Ser Pro Ile Gly His Ala

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225

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ctg ggt ggt aag cag tac atc cag cat gag aat ccg ttt gag gtc ggc  
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Leu Gly Gly Lys Gln Tyr Ile Gln His Glu Asn Pro Phe Glu Val Gly

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atg tct ggc ctg ctt ggt tac ggc gcc tgc gtg gat gcg tcc aat gag  
1121

Met Ser Gly Leu Leu Gly Tyr Gly Ala Cys Val Asp Ala Ser Asn Glu

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255

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265

gcg gat ctg ctg att cta ttg ggt acg gat ttc cct tat tct gat ttc  
1169

Ala Asp Leu Leu Ile Leu Leu Gly Thr Asp Phe Pro Tyr Ser Asp Phe

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ctt cct aaa gac aac gtt gcc cag gtg gat atc aac ggt gcg cac att  
1217

Leu Pro Lys Asp Asn Val Ala Gln Val Asp Ile Asn Gly Ala His Ile

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295

ggt cga cgt acc acg gtg aag tat ccg gtg acc ggt gat gtt gct gca  
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Gly Arg Arg Thr Thr Val Lys Tyr Pro Val Thr Gly Asp Val Ala Ala

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aca atc gaa aat att ttg cct cat gtg aag gaa aaa aca gat cgt tcc  
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Thr Ile Glu Asn Ile Leu Pro His Val Lys Glu Lys Thr Asp Arg Ser

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Ala Val Val Phe Asn Asn Ser Ser Leu Gly Met Val Lys Leu Glu Met

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1841

Phe Ala Glu Ile Ala Ala Ala Ala Gly Ile Lys Ser Val Arg Ile Thr

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Asp Pro Lys Lys Val Arg Glu Gln Leu Ala Glu Ala Leu Ala Tyr Pro

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515

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1937

Gly Pro Val Leu Ile Asp Ile Val Thr Asp Pro Asn Ala Leu Ser Ile

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Pro Pro Thr Ile Thr Trp Glu Gln Val Met Gly Phe Ser Lys Ala Ala

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560

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2083

Arg Ser Asn Ile Arg Asn Ile Pro Thr Pro

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Glu Leu Ala Val Cys Ala Ala Ser Cys Gly Pro Gly Asn Thr His Leu  
65 70 75 80

Ile Gln Gly Leu Tyr Asp Ser His Arg Asn Gly Ala Lys Val Leu Ala  
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Ile Ala Ser His Ile Pro Ser Ala Gln Ile Gly Ser Thr Phe Phe Gln  
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Glu Thr His Pro Glu Ile Leu Phe Lys Glu Cys Ser Gly Tyr Cys Glu  
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Gln Ser Thr Met Ala Gly Lys Gly Val Ser Val Val Val Ile Pro Gly  
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Asp Ile Ala Lys Glu Asp Ala Gly Asp Gly Thr Tyr Ser Asn Ser Thr  
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Ile Ser Ser Gly Thr Pro Val Val Phe Pro Asp Pro Thr Glu Ala Ala  
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Ala Leu Val Glu Ala Ile Asn Asn Ala Lys Ser Val Thr Leu Phe Cys  
195 200 205

Gly Ala Gly Val Lys Asn Ala Arg Ala Gln Val Leu Glu Leu Ala Glu  
210 215 220

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225 230 235 240

Gln His Glu Asn Pro Phe Glu Val Gly Met Ser Gly Leu Leu Gly Tyr  
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Gly Ala Cys Val Asp Ala Ser Asn Glu Ala Asp Leu Leu Ile Leu Leu  
260 265 270

Gly Thr Asp Phe Pro Tyr Ser Asp Phe Leu Pro Lys Asp Asn Val Ala  
275 280 285

Gln Val Asp Ile Asn Gly Ala His Ile Gly Arg Arg Thr Thr Val Lys  
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Tyr Pro Val Thr Gly Asp Val Ala Ala Thr Ile Glu Asn Ile Leu Pro  
305 310 315 320

His Val Lys Glu Lys Thr Asp Arg Ser Phe Leu Asp Arg Met Leu Lys  
325 330 335



Ala His Glu Arg Lys Leu Ser Ser Val Val Glu Thr Tyr Thr His Asn  
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Val Glu Lys His Val Pro Ile His Pro Glu Tyr Val Ala Ser Ile Leu  
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Asn Glu Leu Ala Asp Lys Asp Ala Val Phe Thr Val Asp Thr Gly Met  
 370 375 380

Cys Asn Val Trp His Ala Arg Tyr Ile Glu Asn Pro Glu Gly Thr Arg  
 385 390 395 400

Asp Phe Val Gly Ser Phe Arg His Gly Thr Met Ala Asn Ala Leu Pro  
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His Ala Ile Gly Ala Gln Ser Val Asp Arg Asn Arg Gln Val Ile Ala  
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Met Cys Gly Asp Gly Gly Leu Gly Met Leu Leu Gly Glu Leu Leu Thr  
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Val Lys Leu His Gln Leu Pro Leu Lys Ala Val Val Phe Asn Asn Ser  
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Ser Leu Gly Met Val Lys Leu Glu Met Leu Val Glu Gly Gln Pro Glu  
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Phe Gly Thr Asp His Glu Glu Val Asn Phe Ala Glu Ile Ala Ala Ala  
 485 490 495

Ala Gly Ile Lys Ser Val Arg Ile Thr Asp Pro Lys Lys Val Arg Glu  
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Gln Leu Ala Glu Ala Leu Ala Tyr Pro Gly Pro Val Leu Ile Asp Ile  
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Val Thr Asp Pro Asn Ala Leu Ser Ile Pro Pro Thr Ile Thr Trp Glu  
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780

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831

Met Ala His Ser Tyr Ala Glu Gln Leu Ile

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5

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879

Asp Thr Leu Glu Ala Gln Gly Val Lys Arg Ile Tyr Gly Leu Val Gly

15

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927

Asp Ser Leu Asn Pro Ile Val Asp Ala Val Arg Gln Ser Asp Ile Glu

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35

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975

Trp Val His Val Arg Asn Glu Glu Ala Ala Ala Phe Ala Ala Gly Ala

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gaa tcg ttg atc act ggg gag ctg gca gta tgt gct gct tct tgt ggt  
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Glu Ser Leu Ile Thr Gly Glu Leu Ala Val Cys Ala Ala Ser Cys Gly

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cct gga aac aca cac ctg att cag ggt ctt tat gat tcg cat cga aat  
1071

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1119

Gly Ala Lys Val Leu Ala Ile Ala Ser His Ile Pro Ser Ala Gln Ile

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100

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1167

Gly Ser Thr Phe Phe Gln Glu Thr His Pro Glu Ile Leu Phe Lys Glu

110

115

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tgc tct ggt tac tgc gag atg gtg aat ggt ggt gag cag ggt gaa cgc  
1215

Cys Ser Gly Tyr Cys Glu Met Val Asn Gly Gly Glu Gln Gly Glu Arg

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1263

Ile Leu His His Ala Ile Gln Ser Thr Met Ala Gly Lys Gly Val Ser

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gtg gta gtg att cct ggt gat atc gct aag gaa gac gca ggt gac ggt  
1311

Val Val Val Ile Pro Gly Asp Ile Ala Lys Glu Asp Ala Gly Asp Gly

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165

170

act tat tcc aat tcc act att tct tct ggc act cct gtg gtg ttc ccg  
1359

Thr Tyr Ser Asn Ser Thr Ile Ser Ser Gly Thr Pro Val Val Phe Pro

175

180

185

gat cct act gag gct gca gcg ctg gtg gag gcg att aac aac gct aag  
1407

Asp Pro Thr Glu Ala Ala Ala Leu Val Glu Ala Ile Asn Asn Ala Lys

190

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 220 225 230  
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 1791  
 Ile Glu Asn Ile Leu Pro His Val Lys Glu Lys Thr Asp Arg Ser Phe

315 320 325 330

ctt gat cgg atg ctc aag gca cac gag cgt aag ttg agc tcg gtg gta  
1839

Leu Asp Arg Met Leu Lys Ala His Glu Arg Lys Leu Ser Ser Val Val

335 340 345

gag acg tac aca cat aac gtc gag aag cat gtg cct att cac cct gaa  
1887

Glu Thr Tyr Thr His Asn Val Glu Lys His Val Pro Ile His Pro Glu

350 355 360

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1935

Tyr Val Ala Ser Ile Leu Asn Glu Leu Ala Asp Lys Asp Ala Val Phe

365 370 375

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1983

Thr Val Asp Thr Gly Met Cys Asn Val Trp His Ala Arg Tyr Ile Glu

380 385 390

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2031

Asn Pro Glu Gly Thr Arg Asp Phe Val Gly Ser Phe Arg His Gly Thr

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2079

Met Ala Asn Ala Leu Pro His Ala Ile Gly Ala Gln Ser Val Asp Arg

415 420 425

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2127

Asn Arg Gln Val Ile Ala Met Cys Gly Asp Gly Gly Leu Gly Met Leu

430 435 440

ctg ggt gag ctt ctg acc gtt aag ctg cac caa ctt ccg ctg aag gct  
2175

Leu Gly Glu Leu Leu Thr Val Lys Leu His Gln Leu Pro Leu Lys Ala

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450

455

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2223

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465

470

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2271

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480

485

490

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2319

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2367

Pro Lys Lys Val Arg Glu Gln Leu Ala Glu Ala Leu Ala Tyr Pro Gly

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515

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2415

Pro Val Leu Ile Asp Ile Val Thr Asp Pro Asn Ala Leu Ser Ile Pro

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530

535

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2463

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2511

Arg Thr Val Phe Gly Gly Gly Val Gly Ala Met Ile Asp Leu Ala Arg



555

560

565

570

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2558

Ser Asn Ile Arg Asn Ile Pro Thr Pro

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2678

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Gly Val Lys Arg Ile Tyr Gly Leu Val Gly Asp Ser Leu Asn Pro Ile  
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Val Asp Ala Val Arg Gln Ser Asp Ile Glu Trp Val His Val Arg Asn  
35 40 45

Glu Glu Ala Ala Ala Phe Ala Ala Gly Ala Glu Ser Leu Ile Thr Gly  
50 55 60

Glu Leu Ala Val Cys Ala Ala Ser Cys Gly Pro Gly Asn Thr His Leu  
65 70 75 80

Ile Gln Gly Leu Tyr Asp Ser His Arg Asn Gly Ala Lys Val Leu Ala  
85 90 95

Ile Ala Ser His Ile Pro Ser Ala Gln Ile Gly Ser Thr Phe Phe Gln  
100 105 110

Glu Thr His Pro Glu Ile Leu Phe Lys Glu Cys Ser Gly Tyr Cys Glu  
115 120 125

Met Val Asn Gly Gly Glu Gln Gly Glu Arg Ile Leu His His Ala Ile  
130 135 140

Gln Ser Thr Met Ala Gly Lys Gly Val Ser Val Val Val Ile Pro Gly  
145 150 155 160

Asp Ile Ala Lys Glu Asp Ala Gly Asp Gly Thr Tyr Ser Asn Ser Thr  
165 170 175

Ile Ser Ser Gly Thr Pro Val Val Phe Pro Asp Pro Thr Glu Ala Ala  
180 185 190

Ala Leu Val Glu Ala Ile Asn Asn Ala Lys Ser Val Thr Leu Phe Cys

195

200

205

Gly Ala Gly Val Lys Asn Ala Arg Ala Gln Val Leu Glu Leu Ala Glu  
210 215 220

Lys Ile Lys Ser Pro Ile Gly His Ala Leu Gly Gly Lys Gln Tyr Ile  
225 230 235 240

Gln His Glu Asn Pro Phe Glu Val Gly Met Ser Gly Leu Leu Gly Tyr  
245 250 255

Gly Ala Cys Val Asp Ala Ser Asn Glu Ala Asp Leu Leu Ile Leu Leu  
260 265 270

Gly Thr Asp Phe Pro Tyr Ser Asp Phe Leu Pro Lys Asp Asn Val Ala  
275 280 285

Gln Val Asp Ile Asn Gly Ala His Ile Gly Arg Arg Thr Thr Val Lys  
290 295 300

Tyr Pro Val Thr Gly Asp Val Ala Ala Thr Ile Glu Asn Ile Leu Pro  
305 310 315 320

His Val Lys Glu Lys Thr Asp Arg Ser Phe Leu Asp Arg Met Leu Lys  
325 330 335

Ala His Glu Arg Lys Leu Ser Ser Val Val Glu Thr Tyr Thr His Asn  
340 345 350

Val Glu Lys His Val Pro Ile His Pro Glu Tyr Val Ala Ser Ile Leu  
355 360 365

Asn Glu Leu Ala Asp Lys Asp Ala Val Phe Thr Val Asp Thr Gly Met  
370 375 380

Cys Asn Val Trp His Ala Arg Tyr Ile Glu Asn Pro Glu Gly Thr Arg  
385 390 395 400

Asp Phe Val Gly Ser Phe Arg His Gly Thr Met Ala Asn Ala Leu Pro

405

410

415

His Ala Ile Gly Ala Gln Ser Val Asp Arg Asn Arg Gln Val Ile Ala  
 420 425 430

Met Cys Gly Asp Gly Gly Leu Gly Met Leu Leu Gly Glu Leu Leu Thr  
 435 440 445

Val Lys Leu His Gln Leu Pro Leu Lys Ala Val Val Phe Asn Asn Ser  
 450 455 460

Ser Leu Gly Met Val Lys Leu Glu Met Leu Val Glu Gly Gln Pro Glu  
 465 470 475 480

Phe Gly Thr Asp His Glu Glu Val Asn Phe Ala Glu Ile Ala Ala Ala  
 485 490 495

Ala Gly Ile Lys Ser Val Arg Ile Thr Asp Pro Lys Lys Val Arg Glu  
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Gln Leu Ala Glu Ala Leu Ala Tyr Pro Gly Pro Val Leu Ile Asp Ile  
 515 520 525

Val Thr Asp Pro Asn Ala Leu Ser Ile Pro Pro Thr Ile Thr Trp Glu  
 530 535 540

Gln Val Met Gly Phe Ser Lys Ala Ala Thr Arg Thr Val Phe Gly Gly  
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Gly Val Gly Ala Met Ile Asp Leu Ala Arg Ser Asn Ile Arg Asn Ile  
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Pro Thr Pro

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120

ccggtaccca aaagaaggcc cgccatgagc aggggatatg cgttgatgat ccacaacgct  
180

tgggtttcgg tggctgagag ctgttcacgc agcagagggg gtgcggtgta gagaatcgag  
240

ttgtctacac cgatcagaaa gagaccaccg ctgataacgg cgaggaaagc ccaacgttgg  
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gttttcgtag gcgcttgccg ctgtaagggt tctgaagtca tggatcgtaa ctgtaacgaa  
360

tggtcggtac agttacaact cttttgttgg tgttttagac cacggcgctg tgtggcgatt  
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<210> 7

<211> 613

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120

tacggacatc tttattgcat atccgctgta tctaaccgat catgcagtgc aacgcctgaa  
180

cgcgatcccc ggagaaattt ccattggcgt ggattcggta gagatggcac aggcgacggc  
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gggtttgcgg gaagatatca aggctctgat tgaagtggat tcgggacatc gtagaagtgg  
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agtcacggcg actgcttcag aattgagtca gatccgcgag gcgctgggca gcaggatatgc  
360

aggagtgttt acttttcttg ggcattctta tggcccggga aatggtgagc aggcagcagc  
420

tgatgagctt caggctctaa acaacagcgt ccagcgactt gctggcggcc tgacttctgg  
480

cggttcctcg ccgtctgcgc agtttacaga cgcaatcgat gagatgcgac caggcgtgta  
540

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<400> 11  
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gcctgtaagg tttctgaagt catggatcgt aactgtaacg aatggtcggt acagttacaa  
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aggggactgt cagcgtgggt cgggttcttt gaggcgctta gaggcgattc tgtgaggtca  
420

ctttttgtgg ggtcggggtc taaatttggc cagttttcga ggcgaccaga caggcgtgcc  
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cacgatgttt aaataggcga tcggtgggca tctgtgtttg gtttcgacgg gctgaaacca  
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600

taccaccccg ggcctgaaac tccctggcag gcgggcgaag cgtggcaaca actggaattt  
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cagtgatgat tgatacacct gctgttctca ttgaccgcga gcgcttaact gccaacattt  
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960

atccgctgta tctaaccgat catgcagtgc aacgcctgaa cgcgatcccc ggagaaattt  
1020

ccattggcgt ggattcggta gagatggcac aggcgacggc gggtttgccg gaagatatca  
1080

aggctctgat tgaagtggat tcgggacatc gtagaagtgg agtcacggcg actgcttcag  
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aattgagtca gatccgcgag gcgctgggca gcaggtatgc aggagtgttt acttttcctg  
1200

ggcattctta tggcccggga aatggtgagc aggcagcagc tgatgagctt caggctctaa  
1260

acaacagcgt ccagcgactt gctggcggcc tgacttctgg cggttcctcg ccgtctgcgc  
1320

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20